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Authentic e-learning in higher education

إعداد

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Abstract:

Technologies can be used as powerful cognitive tools when they are used, not for information delivery, but as instruments used by students to solve complex problems. A common way to use technology in universities is to use it to deliver information or teach concepts and skills (learning *from* technology). Another is to teach particular technologies and their uses (learning *about* technology). Perhaps the most powerful use of technology in higher education is where technologies are used as tools (learning *with* technology) in authentic learning environments. This paper argues that e-learning technologies afford the design and creation of truly innovative authentic learning tasks. The theoretical foundations of this approach are strong, and they are explored. A range of strategies are described that draw on principles of authentic learning, and they are illustrated with examples and activities from higher education e-learning contexts. Finally, the paper proposes that a more comprehensive approach to investigating the effectiveness of authentic learning designs can be accomplished through design research.

Introduction

Frequently, when e-learning courses are developed for e-learning or blended delivery in higher education, the design emphasises the transmission of information at the expense of inquiry-based activity to promote thinking and understanding. Information and communication technologies (ICTs) are used too often as disseminators of knowledge, that is, where students learn *from* the technologies rather than *with* them as cognitive tools (Kim & Reeves, 2007; Jonassen & Reeves, 1996).

While the internet has made a huge impact in higher education, with most courses having at least some web presence, many universities have chosen commercial learning management software such as *WebCT*, and *Blackboard* for e-learning course delivery. Through ready-made tools that model information-based modes of delivery, by default, courses revert to more transmissive modes and fail to use the potential of

e-learning technologies to create learning contexts that are varied, complex, innovative, and authentic (Beetham & Sharpe, 2007; Conole & Oliver, 2007). In universities throughout the world, the prevailing model of lectures/tutorials is often forced inflexibly into a platform that in reality has limitless possibilities (Herrington, Reeves, & Oliver, 2005) (Oliver & Herrington, 2001). Lectures are podcast, weekly readings are listed, and discussion topics are led by the teacher—and meanwhile plagiarism is increasing, and students use the web to *search* rather than *research* (Brabazon, 2007).

Authentic learning offers a powerful alternative approach that is not only engaging for students, but offers opportunities for students to acquire deep understanding of underlying constructs and to practice thinking in the way that an expert thinks. It draws upon a wealth of research in constructivist and situated approaches to education.

This paper explores the form and function of authentic learning environments, and provides examples of successful course tasks that use the approach. Examples of types of tasks that are *not* authentic are also given. The paper then examines the use of technology-based cognitive tools in authentic learning, and explores new web technologies that encourage students to participate in the construction of knowledge. Finally, the paper proposes that a more comprehensive approach to investigating the effectiveness of authentic learning designs can be accomplished through design research.

What is authentic learning?

While the concept of *authenticity* is open to multiple interpretations across disciplines, the term has gained broad acceptance within the educational technology literature (Barab, Squire, & Dueber, 2000; Maclellan, 2004; Petraglia, 1998; Stein, Isaacs, & Andrews, 2004).

But what is *authentic learning*? The idea has captured much attention internationally over the last two decades, particularly in the higher education sector. Simply put, it is: 'the notion of learning knowledge and skills in contexts that reflect the way the knowledge will be useful in real life' (Collins, 1988, p. 2). Within any authentic

learning approach, arguably the task that is set for students is the most important component. As Reeves stated: 'It's the task that matters most' (Reeves, 2001).

The importance of tasks in a learning environment was highlighted by Brown, Collins and Duguid (1989) who described authentic tasks as 'the ordinary practices of the culture'. Since then, others have focused on the central function of the task in an authentic learning environment as of paramount importance (e.g., Chambers & Stacey, 1999; Honebein, Duffy, & Fishman, 1993; Lebow & Wager, 1994; Reeves & Reeves, 1997; Stein et al., 2004). According to Cronin (1993), the message for designers and teachers of e-learning environments is a simple one: in designing authentic activities, 'students' experiences … should more closely resemble the experiences they encounter in real life' (p. 80). Some writers and theorists have suggested more specific design criteria for tasks that can enhance students' learning (e.g., Bransford, Vye, Kinzer, & Risko, 1990; Myers, 1993; Young, 1993) as they engage in tasks that reflect the critical characteristics of genuine roles and activities of professionals in real world settings.

Characteristics of authentic tasks

In reflecting on the descriptions of authentic activities described by researchers, we have derived ten characteristics of authentic tasks (Herrington, Oliver, & Reeves, 2003; Herrington, Reeves, & Oliver, 2006; Herrington, Reeves, & Oliver, 2007). These can be used by course creators as a guide to the design and development of authentic tasks:

1. *Authentic tasks have real-world relevance:* Activities match as nearly as possible the real-world tasks of professionals in practice rather than decontextualised or classroom-based tasks (e.g., Brown et al., 1989; Cognition and Technology Group at Vanderbilt, 1990a; Cronin, 1993; Jonassen, 1991; Lebow, 1993; Oliver & Omari, 1999; Resnick, 1987; Winn, 1993; Young, 1993)
2. *Authentic tasks are ill-defined, requiring students to define the tasks and sub-tasks needed to complete the activity:* Problems inherent in the activities are ill-defined and open to multiple interpretations rather than easily solved by the application of existing algorithms. Learners must identify their own unique

tasks and sub-tasks in order to complete the major task (e.g., Bransford, Vye et al., 1990; Cognition and Technology Group at Vanderbilt, 1990a; Lebow & Wager, 1994)

3. *Authentic tasks comprise complex tasks to be investigated by students over a sustained period of time:* Activities are completed in days, weeks and months rather than minutes or hours, requiring significant investment of time and intellectual resources (e.g., Bransford, Vye et al., 1990; Cognition and Technology Group at Vanderbilt, 1990b; Jonassen, 1991; Lebow & Wager, 1994)
4. *Authentic tasks provide the opportunity for students to examine the task from different perspectives, using a variety of resources:* The task affords learners the opportunity to examine the problem from a variety of theoretical and practical perspectives, rather than a single perspective that learners must imitate to be successful. The use of a variety of resources rather than a limited number of preselected references requires students to detect relevant from irrelevant information (e.g., Bransford, Vye et al., 1990; Cognition and Technology Group at Vanderbilt, 1990b; Spiro, Vispoel, Schmitz, Samarapungavan, & Boeger, 1987; Young, 1993)
5. *Authentic tasks provide the opportunity to collaborate:* Collaboration is integral to the task, both within the course and the real world, rather than achievable by an individual learner (e.g., Gordon, 1998; Lebow & Wager, 1994; Young, 1993)
6. *Authentic tasks provide the opportunity to reflect:* Activities need to enable learners to make choices and reflect on their learning both individually and socially (e.g., Gordon, 1998; Myers, 1993; Young, 1993)
7. *Authentic tasks can be integrated and applied across different subject areas and lead beyond domain-specific outcomes:* Activities encourage interdisciplinary perspectives and enable diverse roles and expertise rather than a single well-defined field or domain (e.g., Bransford, Sherwood, Hasselbring, Kinzer, & Williams, 1990; Jonassen, 1991)
8. *Authentic tasks are seamlessly integrated with assessment:* Assessment of activities is seamlessly integrated with the major task in a manner that reflects

real world assessment, rather than separate artificial assessment removed from the nature of the task (e.g., Herrington & Herrington, 1998; Reeves & Okey, 1996; Young, 1995)

9. *Authentic tasks create polished products valuable in their own right rather than as preparation for something else:* Activities culminate in the creation of a whole product rather than an exercise or sub-step in preparation for something else (e.g., Barab et al., 2000; Duchastel, 1997; Gordon, 1998)
10. *Authentic tasks allow competing solutions and diversity of outcome:* Activities allow a range and diversity of outcomes open to multiple solutions of an original nature, rather than a single correct response obtained by the application of rules and procedures (e.g., Bottge & Hasselbring, 1993; Bransford, Sherwood et al., 1990; Bransford, Vye et al., 1990; Duchastel, 1997; Young & McNeese, 1993)

This framework of critical elements has been used to design and/or evaluate a number of technology-based learning environments throughout the world (e.g., Ferry et al., 2005; Gulikers, Bastiaens, & Martens, 2005; Kennedy et al., 2001; Keppell et al., 2003; Koppi & Pearson, 2005; Lee, Lee, & Kim, 2005; Östlund & Svensson, 2005; Pennell, Durham, Ozog, & Spark, 1997; Pountney, Parr, & Whittaker, 2002; Taylor, 2003).

Authentic learning in e-learning courses

Perhaps the best way to illustrate this design approach is through examples of its pedagogical use in a range of e-learning and blended higher education courses.

An authentic research methods course

Many universities teach introductory research methods courses at postgraduate level. A traditional, 'instructivist' approach to teaching a course in research methods online, would be to provide weekly lectures or readings on qualitative and quantitative methods, discussion forums that might focus on a different topic each week, and three assignments that require students to apply learning from the unit. An approach using authentic learning would be quite different. An overall complex and realistic task is

given, in this case, an investigation into the impact of the closure of a school on a rural community (Angus & Gray, 2002). Instead of *learning about* qualitative and quantitative methods as objects of study, students use them in a meaningful, authentic task. An e-learning environment provides both quantitative data (survey, demographics) and qualitative data (interviews, observations, artefacts) that students analyse, and then present their findings as an official report on the impact of the closure of the school on the local community.

Other examples in different e-learning courses include:

History

Students learn the history of World War 1 by researching a real soldier whose name is taken from a local memorial tower or plaque (Morrissey, 2006).

Literature

Students create a real online journal on North American Fiction and Film where they write, then edit and review each other's papers (Fitzsimmons, 2006).

Teacher education in ICTs

Early childhood preservice teachers create a digital story to learn mobile technologies and IT applications (Olney, Herrington, & Verenikina, 2008)

Environmental education

Students use real data to analyse and interpret water quality within a marina and determine whether it is different to well-flushed ocean conditions, and if so explain the possible causes (Lavery, 2001 in Herrington, Reeves, Oliver, & Woo, 2004).

Business studies

Students work in a virtual company to complete a research report for a company director wishing to increase communication within her small business (Pennell et al., 1997)

Biology

Students investigate a simulation of the discovery of microorganisms found in a remote lake in Siberia that cannot be classified. Students analyse the specimens and prepare a report (Koenders, 2002).

While such authentic approaches are intuitively appealing, the approach is often misinterpreted. Many educators begin with the belief that to be authentic, such learning opportunities must be *real*. Our research has provided principles to guide the development of realistic and complex e-learning environments that are not real but *cognitively real*, that is, they provide opportunities to think and act as an expert would, and are much more readily implemented in higher education classes.

Nevertheless, it is sometimes difficult to create realistic and complex tasks that can prompt learning a range of skills and concepts without simplification. Sometimes tasks have a resemblance to authenticity but they are not capable of supporting deep learning and sustained activity.

Non-authentic tasks

In typical higher education course tasks, there is often little resemblance to the kinds of activities and problems people face in real-world situations. Sternberg, Wagner and Okagaki (1993) differentiated between the kinds of problems learners face in academic situations and the kind they face in practical, real-world applications. They contended that academic problems tend to be: formulated by others, well-defined, complete in the information they provide, characterized by having only one correct answer, characterized by having only one method of obtaining the correct answer, disembedded from ordinary experience, and of little or no intrinsic interest.

In contrast to the academic approach, practical problems tend to be characterized by: the key roles of problem recognition and definition, the ill-defined nature of the problem, substantial information seeking, multiple correct solutions, multiple methods of obtaining solutions, the availability of relevant prior experience, and often highly motivating and emotionally involving contingencies (Sternberg et al., 1993, p. 206). Differences between academic and real life approaches have also been investigated by Lebow and Wager (1994), who noted that students' perceptions of academic problems is that they are artificial and not very relevant, whereas authentic problems are perceived as real and worth solving.

When designing authentic tasks it is easy to misconstrue the approach, and to conclude that it is enough to have a semblance of reality, or to include real world

examples. For example, most designers and teachers would recognize that a problem such as the following (Figure 1), while complex and important, has few of the characteristics of authentic tasks listed earlier (such as an authentic context):

Let F be the vector field on $\Re^3$
given by F(x,y,z) = (2xz, -x, y^2)
Evaluate
$\iiint_V \underline{F} dV = (\iiint_V 2xz dV, -\iiint_V x dV, \iiint_V y^2 dV)$
where V is the region bounded by the surfaces
x = 0, y = 0, y = 6, $z = x^2$ and z = 4

Figure 1: Mathematics problem example

There are many misconceptions regarding the form of authentic tasks. The main misconceptions include the following types of tasks:

1. Word problems

Word problems, while attempting to provide a real-world context, fail to replicate the essential elements of a meaningful and realistic problem. For example, consider:

> There are 25 people in a room. How many handshakes would there be, if everyone shook hands with every other person?

There are key mathematical strategies required to solve this problem, but important contextual elements are missing from this problem to make it authentic and relevant. Why would anyone need to know the answer to this question?

A well known example of a false word problem is: If there are 26 sheep and 10 goats on a ship, how old is the captain? This is an example of what Schoenfeld (1991) called *nonreason* (i.e., a willingness to engage in activities that don't make sense). Collins (1988) also discussed *suboptimal schemes* for remembering information to pass tests, which explains why many children give the number 36 as the answer to this problem.

A more complex example from physics might be a question such as the following:

> If a person jumps off a moving bus, how would that affect the speed of the bus?

Again, a sophisticated knowledge of Newtonian motion is needed to solve this problem, but initial consideration of the problem might bring in contextual factors which have not been considered within the parameters of the problem. For example, a student considering an actual instance of someone jumping off a bus (as opposed to an academic word problem) might reflect on why the person jumped, where they jumped from, the weight of the person, and what the driver of the bus did immediately before and after the jump—none of which technically influence the solution.

Bottge and Hasselbring (1993) have pointed out that such word problems are inadequate because:

> They describe situations in a textual rather than a contextual form; they typically include key words such as 'in all' or 'how many more' that can trigger a specific number operation—unlike real problems that offer no such clues; and there is usually only a single correct answer, which takes only a few minutes to solve. (p. 36)

2. Thematic approaches

Thematic approaches to interdisciplinary studies, while worthwhile and complementary to understanding an issue across diverse subject areas, are usually presented as non-authentic tasks. For example, students could study the four seasons from the perspective of science, music, poetry/writing, mathematics and geography.

While such academic endeavour may result in many associations and networks across discipline areas, it is unlikely that such a learning context would result in deep and transferable knowledge for two key reasons. Firstly, thematic approaches are generally constructed solely to suit a curriculum focus rather than as an investigation of a genuine and realistic issue or problem. Secondly, there is rarely a polished product that might be useful in a real-world context —in most cases the product of these tasks resembles an academic assignment.

3. Most computer games

Most computer games, even educational ones, fail as authentic tasks on a number of counts. Games have the capacity to reflect real world contexts and endeavours, using realistic and almost perfect 3D images that enable users to readily engage within their worlds. This is one of their main strengths and they have the potential to represent powerful authentic learning environments.

However, most immersive and real world type games are designed purely for recreational purposes and learning becomes incidental to their purpose. They are usually designed for a single player and while they can create opportunities for real reflection, the ultimate aim is to finish the game rather than to create a genuine and useful product. The failure to engage players in genuine productivity is the key weakness in computer games when measured against authentic task criteria.

4. Some PBL problems

Problem-based learning tasks that are based on Howard Barrows' model of medical education can be engaging and authentic. Two key features of his PBL approach comprise firstly, a rich problem that can be freely explored, and secondly, student-centred learning (Hmelo & Evensen, 2000). These characteristics align well with the characteristics of authentic tasks.

However, many PBL problems present a problem situation which requires a known, best-practice solution, and few PBL tasks require a realistic product beyond the solution of the problem. For example, the PBL genetics problem *When Twins Marry Twins* (Allen, 1999) requires students to solve a complex and genuine problem, but the student is advised that the problem 'can be researched by consulting the textbook alone, and has a content focus that easily fits within the framework of a conventional course' (Para 6). An authentic task would not be able to be completed by reference to a single source of information.

5. Complex problems simplified

In some cases, course teachers and designers have access to rich and detailed resources, such as simulations or web-based resources, which recreate workplaces and other contexts for exploration, but instead of capitalising on the rich complexity of these environments, teachers sometimes reduce and simplify the task.

Such environments have much potential to be used with authentic tasks. For example, a simulated laboratory workplace, created in Quicktime VR, presenting a panorama of the room, would allow students to explore the entire laboratory by panning around and moving in to inspect aspects of interest. A teacher of Occupational Health and Safety (OHS) could give students an overall authentic task requiring them to inspect the virtual laboratory and write an OHS report pointing out any risk factors (as a professional might be required to do). However, a less authentic approach would be one where the teacher simplifies the inspection process, perhaps by breaking the task down into sub-steps, and giving specific questions such as:

- What biological materials are present in the lab?
- What biological hazards are evident?
- How many instances of contamination exist in the lab?
- What preventive measures should be in place?

Spiro et al. (1987) are very strong in their criticism of such oversimplification. They contend such practice is motivated by convenience rather than effectiveness of the learning environment or concern for student learning:

> Simplification of complex subject matter makes it easier for teachers to teach, for students to take notes and prepare for their tests, for test-givers to construct and grade tests, and for authors to write texts. The result is a massive 'conspiracy of convenience'. (p. 180).

These five task examples are shown in summary form in Table 1 below, where each type of task is matched against the characteristics of authentic tasks.

Table 1: Non-authentic tasks matched to characteristics of authentic tasks

Authentic tasks:	Word problems	Thematic approaches	Most video games	Some PBL problems	Complex problems simplified
Have real-world relevance					
Are ill-defined					
Comprise complex tasks investigated over time, using variety of resources					
Provide the opportunity to examine the task from different perspectives					
Provide the opportunity to collaborate					
Provide the opportunity to reflect					
Lead beyond domain-specific outcomes					
Are seamlessly integrated with assessment					
Create polished products valuable in their own right					
Allow competing solutions and diversity of outcome					

All of these types of tasks could be enriched to create engaging and authentic tasks for students with the application of the critical elements used as design guidelines. Further, new technologies of participatory culture are vastly opening up and expanding opportunities for authentic activities in largely unexplored ways.

Participatory culture and cognitive tools

Currently most e-learning environments are delivered to students on a single platform (e.g., through a learning management system like *Blackboard* or *WebCT*). However, now there is a multitude of new ways to communicate and learn using collaborative processes available through Web 2.0 programs. Web 2.0 enables people to communicate and learn from each other directly. As Tim O'Reilly puts it: 'Web 2.0

has embraced the power of the web to harness collective intelligence'. It has introduced powerful tools like wikis (such as *Wikipedia*, an online encyclopedia where anyone can write or edit entries), blogs or web logs (where anyone can publish their thoughts and news), and social networking spaces (such as *Facebook* that allow users to publish and share personal profiles, photographs, and music).

Web 2.0 functions allow the creation of collaborative, shared knowledge creating *participatory cultures* (Jenkins, 2007). However, universities are reluctant to incorporate such public knowledge sharing into tasks and assessment processes (Conole & Fill, 2005; Kolbitsch & Maurer, 2006). Surowiecki (2004) argued that the shared 'wisdom of the crowd' can be more accurate and insightful (because of the range of experience and reflections) than any *single* expert opinion in some problem-solving situations. Others have challenged this view, calling the rise of shared knowledge on the internet 'the tyranny of the ignorant' or the 'cult of the amateur' (Keen, 2007).

It is clear that universities must adapt their methods to employ the powerful technologies that are becoming more and more central to the lives of both students and teachers. Mobile technologies such as mobile phones and mp3 player (and increasingly hybrid devices) are technologies that most students have in their pockets. These devices have much potential and can be used as cognitive tools in a range of educational contexts (Traxler, 2007; Sharples, 2006; Jacob & Issac, 2008; Herrington, Mantei, Herrington, Olney, & Ferry, 2008), and yet universities struggle to accommodate them with policies that are unable to account for student-owned technologies (New Media Consortium, 2008).

Many university teachers have sought to ban these types of web technologies and mobile devices (such as phones and PDAs) in an effort to ensure students remain focused on the task at hand. However, parallels can be drawn with the early days of calculators when many teachers banned their use in mathematics classes, although now they are clearly acknowledged as powerful cognitive tools. They can be used as tools within authentic learning environments, and we need to know how best to enable this to occur. *Cloud Computing* and *Virtual Worlds* are the two technologies noted by the Australia-New Zealand New Media Consortium as 'imminent', and predict their

time to become mainstream in education will be one year (NMC, 2008). However, most universities have barely conceived the educational potential of these technologies much less anticipated and prepared policies to enable their use in e-learning.

The pedagogical implications of these technologies are significant when they are used as cognitive tools. Jonassen and Reeves (1996) explored the theoretical parameters of cognitive tools, describing them as: 'reflection tools that amplify, extend, and even reorganize human mental powers to help learners construct their own realities and solve challenging tasks' (p. 699). David Jonassen (1994) captured the affordances of technology in this regard when he wrote: 'Students cannot use [cognitive] tools without thinking deeply about the content that they are learning, and second, if they choose to use these tools to help them learn, the tools will facilitate the learning process'. Participatory tools are ideal to enable this process. However, we need to research their affordances and use in higher education e-learning, and how they can best impact on the quality of people's lives.

Conclusion

In this paper, the theoretical and practical foundations of authentic learning and tasks have been explored. Authentic learning is appealing as a pedagogical approach on at least four counts:

1. Authentic learning situates knowledge in realistic work-related contexts, thereby preparing learners for the activities of a professional working life;
2. Realistic tasks cognitively challenge learners to solve problems and think in the same ways as professionals working in real world contexts;
3. Complex tasks require the creation of real products and artefacts, and are more worthy of the investment of time and effort than decontextualised tasks.
4. Technology-based cognitive tools (such as computer software, Web 2.0 and mobile devices) can be used both in the processes and products of the e-learning environment.

However, more research needs to be done to document the foundations of the success of the approach, and how to replicate its features consistently in pedagogy. One way to achieve this is through *design research*.

Design research is a research approach that aims to make both practical and scientific contributions. The key strategies for design research include: (1) Working closely with practitioners (2) Creating a prototype e-learning environment (3) Testing and refining the e-learning environment until the learning outcomes are reached, and (4) Reflecting on the process and sharing reusable design principles that can help other educators and researchers solve the same sorts of problems (Reeves, 2006). The approach is apt for the authentic approach suggested in this paper because teachers can create authentic environments and tasks for e-learning based on consultations with teachers and practitioners; they can design their learning environments using theory appropriate to the task and the affordances of technology; they can implement and evaluate in iterative cycles; and then they can share their findings in the form of design principles that others can follow.

Design research offers much hope, not only for the future quality of educational technology research, but also for determining practical and sound advances in effective pedagogy using authentic tasks.

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